What is claimed:

1. A lidar system comprising:

a transmitter for transmitting an optical beam having a primary wavelength between about 1.5 – 1.8 microns and having a first value of divergence; and

a receiver for receiving scattered radiation of said optical beam, said receiver having a second value of field of view defined by a detector surface and detector optics;

wherein said second value field of view of said detector subsystem is at least about as great as said first value of divergence of said transmitter subsystem.

2. A lidar system as set forth in Claim 1, wherein said transmitter comprises a laser pump for providing a source beam having a source wavelength different than said first wavelength and a wavelength shifter for shifting said source beam from said source wavelength to said first wavelength.

3. A lidar system as set forth in Claim 2, wherein said wavelength shifter comprises a Raman wavelength shifter.

4. A lidar system as set forth in Claim 3, wherein said Raman wavelength shifter includes at least one internal reflectance element for redirecting said beam within a housing of said Raman wavelength shifter substantially free from surface reflection.

5. A lidar system as set forth in Claim 3, wherein said Raman wavelength shifter comprises at least one optical element disposed at a Brewster angle with respect to said beam.

6. A lidar system as set forth in Claim 3, wherein said transmitter further comprises a seed laser for providing a seed beam for transmission to said Raman wavelength shifter together with said source beam.

7. A lidar system as set forth in Claim 6, wherein said source beam and said seed beam have substantially equal beamwidths and are arranged for substantially coaxial transmission to said Raman wavelength shifter.

8. A lidar system as set forth in Claim 3, wherein said transmitter further comprises a beam compressor disposed between said laser pump and said Raman wavelength shifter for compressing said source beam from a first width to a second width less than said first width substantially free from focusing in relation to said Raman wavelength shifter.

9. A lidar system as set forth in Claim 3, wherein said transmitter further comprises a gas circulation system for circulating a gas relative to a housing of said Raman wavelength shifter.

10. A lidar system as set forth in Claim 9, wherein said gas circulation system comprises a gas pump disposed outside of said housing.

11. A lidar system as set forth in Claim 3, wherein said transmitter further comprises a beam expander for receiving said optical beam from said Raman wavelength shifter and expanding said beam from a first beamwidth to a second beamwidth greater than said first beamwidth.

12. A lidar system as set forth in Claim 3, wherein said transmitter further comprises a filter for receiving an output beam from said Raman wavelength shifter and removing a component therefrom associated with said source wavelength.

13. A lidar system as set forth in Claim 1, wherein said receiver comprises collection optics for collecting said backscattered radiation into a compressed beam, a detector for converting incident radiation into an electrical signal representative of said incident radiation, and focusing optics interposed between said collection optics and said detector for receiving said compressed beam and directing said compressed beam onto an active detector surface of said detector.

14. A lidar system as set forth in Claim 13, wherein said collection optics comprises a telescope.

15. A lidar system as set forth in Claim 13, wherein said receiver further comprises a collimator disposed between said collection optics and said focusing optics for collimating said said compressed beam and a filter, disposed between said collimator and said focusing optics, for filtering said compressed beam on a wavelength dependent basis.

16. A lidar system as set forth in Claim 13, wherein said detector comprises an InGaAs conversion medium

17. A lidar system as set forth in Claim 1, wherein said transmitted optical beam and said received scattered radiation are substantially coaxial.

18. A lidar system as set forth in Claim 1, wherein said second value is between about 1.0 and 1.5 times said first value.

19. A lidar system as set forth in Claim 1, further comprising a scanner for scanning said optical beam relative to at least one scan axis.

20. A lidar system as set forth in Claim 19, wherein said scanner is operative to scan said optical beam relative to two axes.

21. A lidar system as set forth in Claim 1, wherein said optical beam has a pulse energy of at least about 100 mJ/pulse.

22. A lidar system as set forth in Claim 1, wherein said optical beam has a pulse repetition frequency of at least about 10 Hz.

23. A lidar system as set forth in Claim 1, wherein said receiver comprises a processor for generating an atmospheric aerosol image based on data acquired in less than 1 second by said detector.

24. A lidar system, comprising:

a transmitter for transmitting an optical beam having a nominal wavelength between about 1.5 – 1.8 microns;

a receiver for detecting scattered radiation of said optical beam; and

a scanner, operatively associated with said transmitter and detector subsystems, for scanning said transmitted beam across an angular range of interest to provide a profile of aerosol related information across said range of interest.

25. A lidar system as set forth in Claim 24, wherein said scanner is operative to scan said optical beam relative to two axes.

26. A lidar system as set forth in Claim 24, wherein said optical beam has a pulse energy of at least about 100 mJ/pulse.

27. A lidar system as set forth in Claim 24, wherein said optical beam has a pulse repetition frequency of at least about 10 Hz.

28. A lidar system as set forth in Claim 24, wherein said receiver comprises a processor for constructing said profile from intermediate sample periods where each of the sample periods corresponds to a measurement interval of less than 1 second.

29. A lidar system comprising:

a tranmitter for transmitting an optical beam; and

a receiver for receiving backscattered radiation of said optical beam and processing said backscattered radiation to atmospheric aerosol related information;

wherein said lidar system provides a signal-to-noise ratio greater than 10 at a distance of 15 km for an optical signal integration time of less than 0.1 second and a beam elevation of less than 5 degrees.

30. A ground-based transmitter, comprising:

a laser pump for generating a source beam having a first nominal wavelength;

beam directing optics for directing a wavelength shifted beam from near ground elevation into the atmosphere; and

a beam processor operatively interposed between the laser pump and said beam directing optics including a wavelength shifter for providing said wavelength shifted beam having a nominal wavelength between about 1.5 – 1.8 microns and optics for conditioning said wavelength shifted beam, wherein said beam processing subsystem is operative to provide said wavelength shifted beam with a divergence of less than about 0.5 mrad.

31. A transmitter system as set forth in Claim 30, wherein said wavelength shifter comprises a Raman wavelength shifter.

32. A transmitter system as set forth in Claim 30, wherein said Raman wavelength shifter includes at least one internal reflectance element for redirecting said beamwidth in a housing of said Raman wavelength shifter substantially free from surface reflection.

33. A transmitter system as set forth in Claim 31, wherein said Raman wavelength shifter comprises at least one optical element disposed at a Brewster angle with respect to said beam.

34. A transmitter system as set forth in Claim 31, wherein said beam processor further comprises a seed laser for providing a seed beam for transmission to said Raman wavelength shifter together with said source beam.

35. A transmitter system as set forth in Claim 31, wherein said beam processor further comprises a beam expander for receiving said optical beam from said Raman wavelength shifter and expanding said beam from a first beamwidth to a second beamwidth greater than said first beamwidth.

36. A transmitter system as set forth in Claim 30, wherein said beam processor further comprises a scanner for scanning said optical beam relative to at least one scan axis.

37. A transmitter system as set forth in Claim 36, wherein said scanner is operative for scanning said optical beam free from movement of said beam processor.

38. A ground-based transmitter, comprising:

a laser pump for generating a source beam having a first nominal wavelength;

beam directing optics for directing a processed beam from near ground elevation into the atmosphere; and

a beam processor operatively interposed between the laser pump and said beam directing optics for modifying at least one of a wavelength and a beamwidth of said source beam to produce said processed beam, wherein said processed beam has a pulse energy of at least 100 mJ/pulse, a divergence of no greater than 0.5 mrad and has an energy within the eye-safety standards of American National Standard for the Safe Use of Lasers, ANSI Z136.1-2000.

39. A transmitter as set forth in Claim 38, wherein said beam processor comprises a Raman wavelength shifter.

40. A transmitter as set forth in Claim 38, wherein said beam processor comprises a beam expander for expanding said beam from a first beamwidth to a second beamwidth greater than said first beamwidth.

41. A transmitter as set forth in Claim 38, further comprising a scanner for scanning said optical beam relative to at least two axes.

42. A transmitter as set forth in Claim 41, wherein said scanner is operative for scanning said beam free from movement of said beam processor.

43. A transmitter, comprising:

a laser pump for generating a pulsed source beam having a first nominal wavelength and a first pulse energy; and

a Raman wavelength shifter for providing a wavelength shifted pulsed beam, said Raman cell having a pressure of no more than about 15 atm, wherein said wavelength shifted pulsed beam has a second pulse energy that is at least about 25% of said first pulse energy.

44. A transmitter as set forth in Claim 43, wherein said Raman wavelength shifter includes at least one internal reflectance element for redirecting said beam within a housing of said Raman wavelength shifter substantially free from surface reflection.

45. A transmitter as set forth in Claim 43, wherein said Raman wavelength shifter comprises at least one optical element disposed in a Brewster angle with respect to said beam.

46. A transmitter as set forth in Claim 43, further comprising a seed laser for providing a seed beam for transmission to said Raman wavelength shifter together with said source beam.

47. A transmitter as set forth in Claim 43, further comprising a beam compressor disposed between said laser pump and said Raman wavelength shifter for compressing said source beam from a first width to a second width less than said first width substantially free from focusing in relation to said Raman wavelength shifter.

48. A transmitter as set forth in Claim 43, further comprising a gas circulation system for circulating a gas relative to a housing of said Raman wavelength shifter.

49. A transmitter as set forth in Claim 48, wherein said gas circulation system comprises a gas pump disposed outside of said housing.

50. A transmitter, comprising:

a laser pump for generating a source beam having a first nominal wavelength;

a Raman wavelength shifter for providing a wavelength shifted beam having a wavelength between about 1.5 – 1.8 microns, and

a seed source for providing a seed beam for transmission into said Raman wavelength shifter together with said source beam.

51. A transmitter as set forth in Claim 50, further comprising a beam compressor disposed between said laser pump and said Raman wavelength shifter for compressing said source beam from a first a width to a second width less than said first width substantially free from focusing in relation to said Raman wavelength shifter.

52. A transmitter as set forth in Claim 50, wherein said source beam and said seed beam are arranged for substantially coaxial transmission to said Raman wavelength shifter and have substantially equal beamwidths at said Raman wavelength shifter.

53. A receiver, comprising:

collection optics for receiving backscattered radiation of a transmitted optical beam and collecting the radiation into a compressed beam;

a detector for converting incident radiation into an electrical signal representative of the incident radiation; and

focusing optics interposed between the collection optics and the detector for receiving the compressed beam and focusing the compressed beam onto a photoactive surface of a detector.

54. A receiver as set forth in Claim 53, wherein said collection optics comprises a telescope.

55. A receiver as set forth in Claim 53, further comprising a collimator disposed between said collection optics and said focusing optics for collecting said compressed beam and a filter, disposed between said collimator and said focusing optics, for filtering said compressed beam on a wavelength dependent basis.

56. A receiver as set forth in Claim 53, wherein said detector comprises an InGaAs coversion medium.

57. A receiver, comprising:

collection optics for receiving backscattered radiation of a transmitted optical beam, said collection optics having a defined focal length; and

an active detector surface having a detector dimension, said detector dimension being one of a radius and a semi-major axis.

58. A receiver as set forth in Claim 57, wherein said receiver has a field of view, calculated as the detector dimension divided by focal length of the collection optics less than 0.5 mrad and a range resolution of no more than 50 m.

59. A receiver as set forth in Claim 57, wherein said range resolution is less than 10 m.

60. A receiver as set forth in Claim 57, wherein said collection optics comprises a telescope optically coupled to said active detector surface.

61. A receiver as set forth in Claim 57, wherein said active detector surface comprises an InGaAs conversion medium.

62. A receiver, comprising:

a detector for converting 1.5 – 1.8 micron wavelength wavelength into an electrical signal; and

a telescope optically coupled to said detector, wherein said telescope has a transmissivity of at least 70% for the 1.5 – 1.8 micron wavelength range.

63. A receiver as set forth in Claim 61, wherein said telescope has a transmissivity of at least 85% for the 1.5 – 1.8 micron wavelength range.

64. A method for analyzing atmospheric aerosols, comprising the steps of:

transmitting a beam having a wavelength of between about 1.5 – 1.8 microns and a first value of divergence into the atmosphere; and

receiving backscattered radiation of said beam using a receiver having a second value of field of view at least about equal to said first value of divergence.

65. A method for generating an eye-safe beam for transmission into the atmosphere, comprising the steps of:

generating a source beam having a first nominal wavelength;

generating a seed beam having a wavelength substantially equal to said first wavelength of said source beam;

optically combining said source beam and said first beam; and

transmitting said combined source beam and seed beam into a Raman wavelength shifter to provide an output beam having a wavelength in the range between 1.5 – 1.8 microns.

66. A method for processing backscattered radiation of the transmitted optical beam, comprising the steps of:

receiving the backscattered radiation using collection optics so as to provide a compressed beam;

receiving said compressed beam using focusing optics to provide a focus beam; and

receiving said focused beam on a detector surface to provide an electrical signal representative of the backscattered radiation.